specific shapes. Being able to visualize atomic orbitals is essential to understanding the forma of chemical bonds and molecular geometry, which are discussed in Chapters 5 and 7. In this tion, we will look at each type of orbital separately.

s Orbitals

For any value of the principal quantum number (n), the value 0 is possible for the angular mom tum quantum number (ℓ), corresponding to an *s* subshell. Furthermore, when $\ell = 0$, the magn quantum number (m_ℓ) has only one possible value, 0, corresponding to an *s* orbital. Theref there is an *s* subshell in every shell, and each *s* subshell contains just one orbital, an ***s orbital.***

Student Annotation: The radial probability distribution can be thought of as a map of "where the electron spends most of its time."

Figure 3.18 illustrates three ways to represent the distribution of electrons: the probabi density, the spherical distribution of electron density, and the radial probability distribution probability of finding the electron as a function of distance from the nucleus) for the 1*s*, 2*s*, an

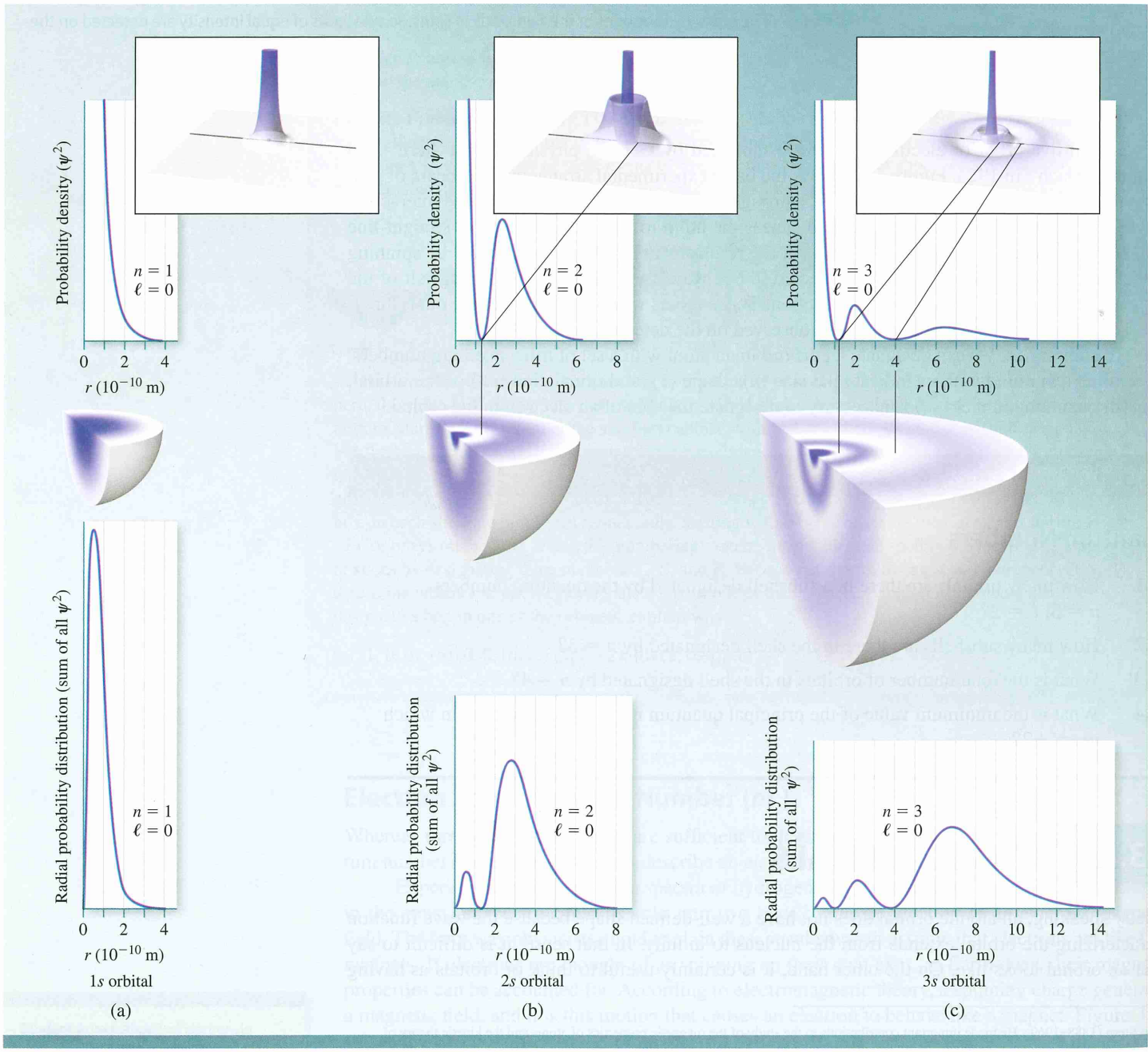

Figure 3.18 From top to bottom, the *probability density* and corresponding relief map, the distribution of electron density represented spherically with shading corresponding to the relief map above, and the *radial probability distribution* for (a) the 1*s*, (b) the 2*s*, and (c) the 3*s* orbitals of hydrogen.

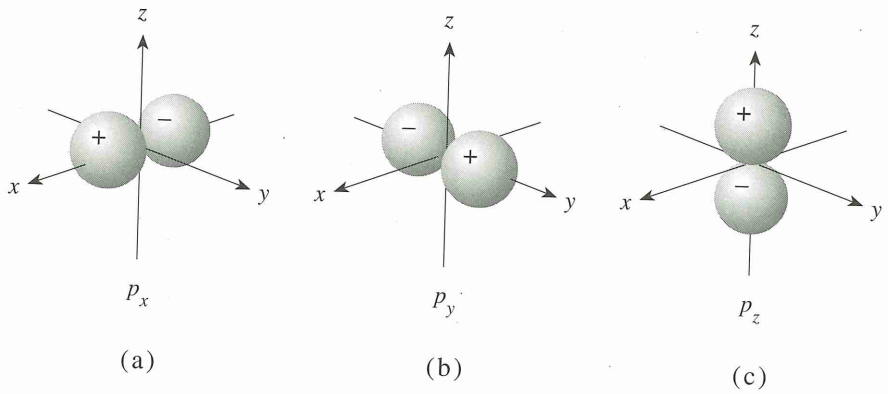

FIGURE 6.4
Three-dimensional polar plots of the angular part of the real representation of the hydrogen atomic wave functions for $l = 1$ (see Equations 6.62 for real representations of p_x and p_y.)

and then represent the value of $\psi^*\psi$ by the density of dots in a picture. Figure 6.5 shows such plots for several orbitals.

An alternate way to represent complete wave functions is as contour maps. Figure 6.6a shows a contour map for a 1*s* orbital. The nine contours shown in each case in Figure 6.6 enclose the 10%, 20%, . . ., 90% probability of finding the electron within

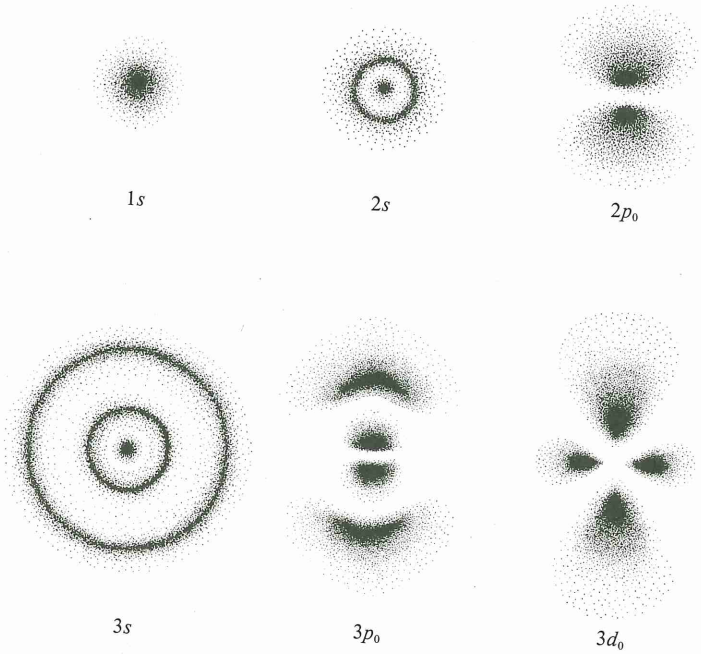

FIGURE 6.5
Probability density plots of some hydrogen atomic orbitals. The density of the dots is proportional to the probability of finding the electron in that region.